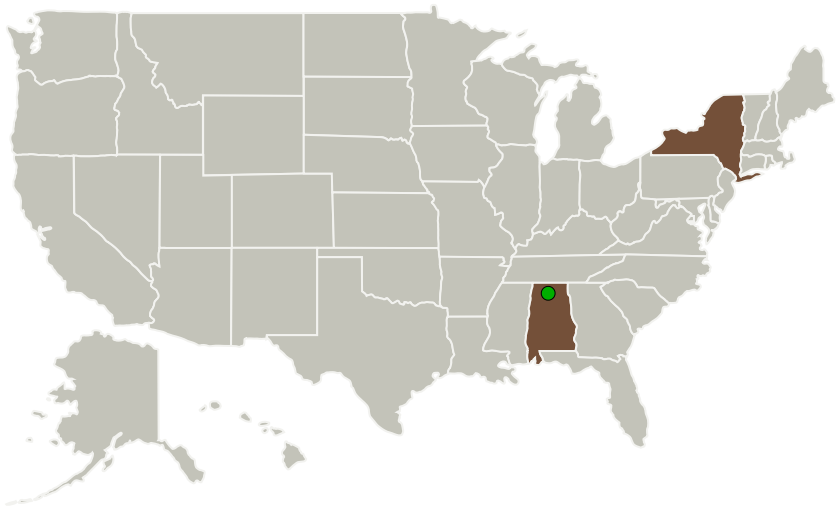
Light Weight, Scalable Manufacturing of Telescope Optics, Phase II

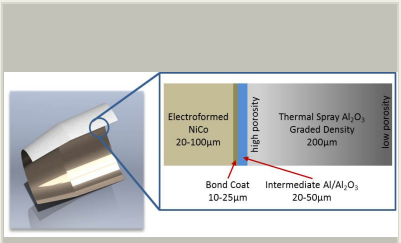
Completed Technology Project (2014 - 2017)

Project Introduction

NASA's future X-ray astronomy missions will require X-ray optics that have large effective areas, are lightweight, and cost effective. Recent X-ray telescopes, such as the Chandra Observatory, utilized reflectors made from zerodur which were up to 20mm thick. The thickness of these reflectors, as well as the mass, limited the number of nested optics that could be implemented. Current state of the art telescopes, such as those found on XMM-Newton, utilize reflectors made from an electroforming process with shell thicknesses on the order of 1mm. This reduction in thickness has enabled a larger number of reflectors to be implemented, 58 nested reflectors in the case of XMM-Newton, but the weight still needs to be significantly reduced for future missions. The proposed innovation seeks to improve upon the current state of the art by replacing much of the NiCo with a stiff, lightweight, ceramic material. A thermal spray process, which was tested for feasibility in Phase I, will be enhanced to allow for the deposition of porosity graded alumina onto the rear surface of the NiCo reflector. Several diagnostic techniques will be employed to adjust the in-flight particle state as well as the residual stress of the coating as to not adversely affect the micro roughness of the optical surface as well as the figure accuracy of the optic. The gradation of the alumina layer will allow for CTE matching with the electroformed shell as well as optimization of the ceramic stiffness. By reducing the NiCo layer from 1mm to less than 100um with a 200um alumina layer as the support structure the overall mass of the telescope can be greatly reduced allowing for a greater number of reflectors to be nested.

Primary U.S. Work Locations and Key Partners





Light Weight, Scalable Manufacturing of Telescope Optics, Phase II

Table of Contents

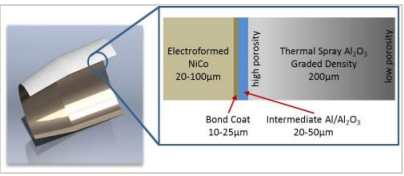
Light Weight, Scalable Manufacturing of Telescope Optics, Phase II

Completed Technology Project (2014 - 2017)

Organizations Performing Work	Role	Type	Location
ReliaCoat Technologies, LLC	Lead Organization	Industry	East Setauket, New York
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	New York

Images



Briefing Chart Image
Light Weight, Scalable Manufacturing of Telescope Optics, Phase II
(https://techport.nasa.gov/image/134400)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
ReliaCoat Technologies, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Christopher J Jensen

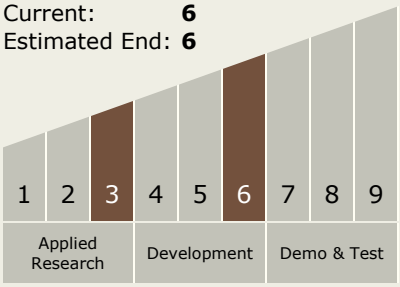
Co-Investigator:
Christopher D Jensen

Light Weight, Scalable Manufacturing of Telescope Optics, Phase II

Completed Technology Project (2014 - 2017)

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System